

Immunity from Mosquito Bites.

THE note of your correspondent (NATURE, No. 1438), relative to the above subject, leads me to point out that my own experience is the counterpart of that there presented. More than twenty years ago, as a young man, I camped during the months of May and June in the forest which bordered the south shore of Lake Superior, a region teeming with varied forms of insect-life, among which the mosquito held a conspicuous although not the most obnoxious place. I had previously been very sensitive to mosquito stings, and suffered acutely from them during the entire period spent in camp, my hands and face being so closely covered with the peculiar hard lumps resulting from the sting, that they presented in place of soft flesh only a series of contiguous swellings.

The temporary discomfort thus occasioned has since been abundantly recompensed. For many years afterwards mosquitoes displayed a marked antipathy towards my blood, rarely stinging me if any other person were available as a subject for their attacks. This kind of immunity I have now partially lost, but even to the present time a mosquito sting occasions me very little annoyance. It is followed by no swelling, and the pain ceases within a few moments after the proboscis is withdrawn.

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Sound Signals in Fog.

REFERRING to one of your Notes on page 130, I will take the opportunity of repeating a suggestion which I have several times made privately, viz. to have on board ship not a double emitter but a double receiver of sound:—a pair of trumpet-mouths or collectors or ears, one at each side of the ship, with the bulk of the ship as a shadow-throwing object between (like the head), and with tubes leading from them into the the captain's or other quiet cabin. The listen-out-man, having these tubes in his ears, would be able to hear distant sounds and estimate their direction with greater precision than if he trusted to his own small collecting organs, but I apprehend in just the same sort of way, and almost without training.

June 12.

OLIVER J. LODGE.

Fire-fly Light.

IN answer to Prof. Silvanus Thompson's inquiry in NATURE of June 10, it may be stated that the "Johanniskäfer," or "Johanniswürmchen," is the common glow-worm, *Lampyrus noctiluca*, L., or *Lampyrus splendidula*, L.

Zürich, June 12.

E. OVERTON.

THE APPROACHING TOTAL ECLIPSE OF THE SUN.

I.

THE failure of so many of the eclipse parties last year to secure observations, makes it a matter of congratulation that the weather prospects of the eclipse to be observed in India on January 22 next year seem to be as favourable as they possibly can be. I propose in the present article to refer generally to the objects to be attained, and to give an account of the proposed arrangements so far as I know them; and to show how fair the prospect of success this time is, I will begin by referring to a note drawn up by Mr. Eliot, F.R.S. Meteorological Reporter to the Government of India, in order to give the chief meteorological features of the tract of country in India through which the line of totality will pass.

The note begins by giving a general idea of the Indian climate.

"It may be premised that the year in India may be divided into two seasons or periods—the north-east or dry monsoon (or season), and the south-west or wet monsoon. During the south-west monsoon winds of oceanic origin prevail, and the whole of the period is one of frequent rain over the greater part of India. The chief features of this period, lasting from June to December, are moderately high temperature, moderate diurnal range of temperature, high humidity, much cloud, and more or

less frequent rain. The amount of cloud and rain differ very considerably in different parts of the country, depending upon their position with respect to the neighbouring seas and the mountain ranges in India, and other conditions. The south-west monsoon winds usually withdraw from Northern India in September or October, and from the Bay of Bengal and Southern India in December. Hence the months of November and December form a transition period from the conditions of the wet to the dry monsoon, the change commencing in Upper India, and extending slowly eastwards and southwards.

"During the dry or north-east monsoon (extending from January to May), winds of land origin prevail in the interior of India. In Northern India these land winds blow down the larger river valleys, and are hence westerly over the Gangetic plain, the largest river plain in India.

"The first two months, January and February, form the cool weather of Northern and Central India and the Deccan. The mean temperature of the day ranges between an average of 71° in the Deccan (Berar, the Central Provinces, and Hyderabad), and 54° in the Punjab. The diurnal range of temperature is large in amount, varying between 25° to 35° or 40° in the interior. The air is usually very dry, skies free from cloud, and winds light, more especially in the Punjab and more remote districts of the interior. The disturbances of this period are feeble cyclonic storms of large extent, which cross Northern India from west to east, and give much cloud and light, to moderate rain in the plains and hills of Northern India. Temperature increases rapidly in March, and that month and the two following months of April and May form the hot weather season. The intensity of the hot weather conditions increases from March to May. The chief features of the weather of this period in the interior of India are high day temperature, large diurnal range of temperature, great dryness of the air, and strong day winds which raise clouds of dust, and more or less obscure the sky and sun. Cyclonic storms of large extent are of comparatively rare occurrence in this period. On the other hand, small local hot weather storms—including hailstorms, thunderstorms, and duststorms—are of frequent occurrence, and tornadoes are of occasional occurrence, in Bengal chiefly."

It follows from this sketch that the eclipse will occur in the middle of the cold weather and at the most favourable time of the year for travelling in India. Light north-east winds, fine weather, and smooth sea are to be expected. Cyclonic storms are of exceedingly rare occurrence in either sea during the month, and the chance of a gale or of stormy weather in the month off the coast of the Konkan (from Bombay to Karwar) is, according to Mr. Eliot, less than 1/50. He states:—

"The weather is throughout the month of January almost uniformly fine, with clear or lightly-clouded skies over the whole of the Peninsula. Light north-easterly to easterly winds obtain in the Deccan, or interior of the Peninsula. The west coast districts are protected by the West Ghats from these winds, and light land and sea breezes prevail. The most remarkable feature of the meteorology of the coast area from Bombay south to Karwar in January is the freedom of the skies from cloud. Disturbances are of very rare occurrence, and fine weather is hence almost a certainty during the whole of the month. There is, however, usually much dust in the air, raised by the dry winds in the Deccan."

Among other most important matter in Mr. Eliot's note is a table showing average temperature, humidity, cloud and rainfall data in January at certain stations in India near the line of totality. We gather that the mean temperature of the month of January in the Konkan coast districts is 76°, with a diurnal range of 20°. In the Deccan (i.e. at Sholapur, &c.) and the Central Provinces the mean temperature of the day in January is approximately 70°, and the diurnal range nearly 30°. In Bihar the mean daily temperature of the month is 62°, and the diurnal range 23°.

Mr. Eliot points out that since the air is very dry over the interior, and the mean daily humidity percentages at stations in the Deccan, Central Provinces, and Berar averages about 40°, any instruments brought out from Europe, such as photographic cameras, &c., should be constructed to withstand the action of this great dryness

of the air. With regard to cloud, the data show that the coast districts between Karwar and Ratnagiri (which includes the line of totality) is on the mean of the month more free from cloud than any other part of the line of totality.

"The amount of cloud is practically uniform in amount over the Deccan and Central Provinces, and is slightly greater in Bihar than in the Deccan or Central Provinces. The amount of cloud is very large at Darjeeling in January, and mist or fog almost invariably forms after clear nights in the morning (about 9 or 10 a.m.), and prevails more or less steadily until late in the afternoon, when it gradually disappears."

Rain is of rare occurrence during the month of January in the Konkan and Deccan. Its probability increases in proceeding from west to east. In the Konkan the average number of rainy days in the month is only 0.2,

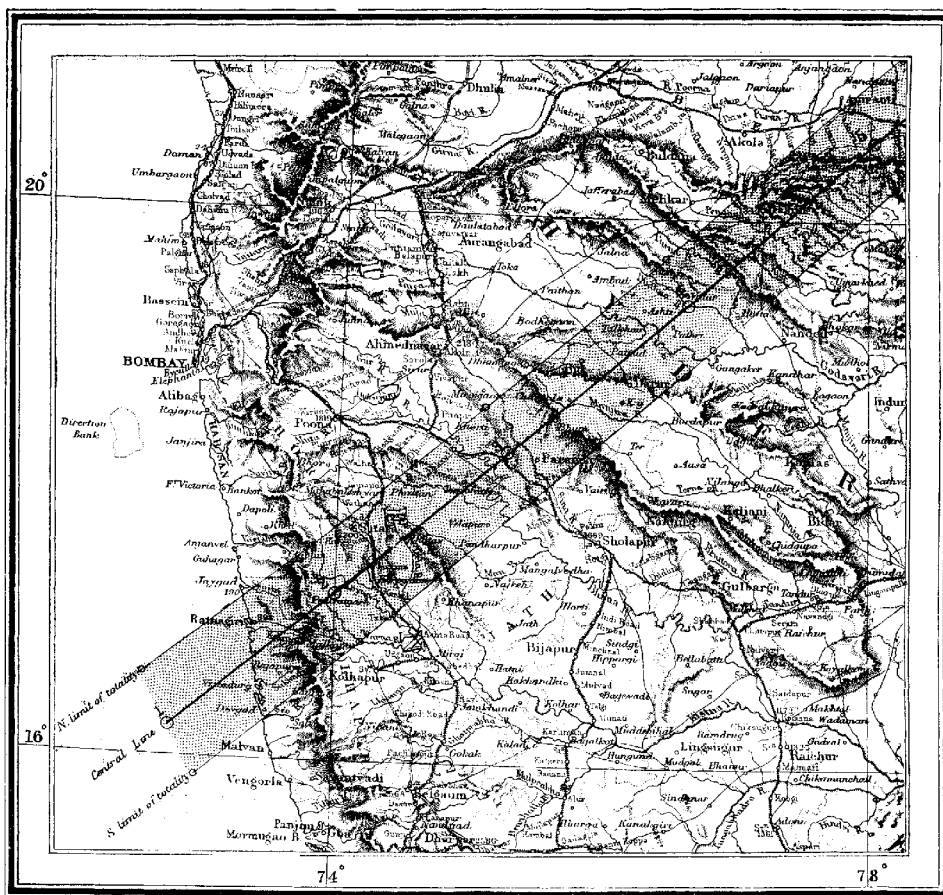
ticulars" issued from the Nautical Almanac Office. Local mean times and the points of contact for direct image are given.

Rajapur ... Long. $73^{\circ} 35' E.$, Lat. $16^{\circ} 40' N.$

	d.	h.	m.	s.	N. Point.	Vertex.	Sun's altitude.
Eclipse begins January	21	23	13	58	$121^{\circ} W.$	$100^{\circ} W.$	52°
Totality begins	"	22	0	47	Duration 2m. 18.9		53°
Totality ends	"	22	0	49			
Eclipse ends	"	22	2	15	$55^{\circ} E.$	$13^{\circ} E.$	44°

Nagpur ... Long. $79^{\circ} 8' E.$, Lat. $21^{\circ} 9' N.$

	d.	h.	m.	s.	N. Point.	Vertex.	Sun's altitude.
Eclipse begins January	21	23	56	20	$123^{\circ} W.$	$118^{\circ} W.$	50°
Totality begins	"	22	1	26	Duration 1m. 17s.7		46°
Totality ends	"	22	1	27			
Eclipse ends	"	22	2	49	$55^{\circ} E.$	$10^{\circ} E.$	35°



Reg. No. 538 R., Asiatic Society.—July 26.—40.

FIG. 7.—The central line of Eclipse in Western India.

and in the eastern districts of the North-western Provinces the average number is 2, and in Bihar 1.2.

"The probability of a rainy day in January is hence about six times as great in Bihar as in the Konkan in January. The probability of any given day in January being rainy in the Konkan is less than $1/150$, and in Bihar $1/25$."

Mr. Eliot remarks, in connection with this, that skies are usually remarkably clear after rain in the Gangetic plain, and the atmospheric conditions for astronomical observations are at such times much finer than are ever obtainable in the Konkan or Deccan.

The local astronomical conditions at three points along the line of totality are thus stated in the "local par-

Position south of Benares ... Long. $83^{\circ} 0' E.$, Lat. $24^{\circ} 40' N.$

	d.	h.	m.	s.	N. Point.	Vertex.	Sun's altitude.
Eclipse begins January	22	0	24	56	$123^{\circ} W.$	$128^{\circ} W.$	46°
Totality begins	"	22	1	51	Duration 1m. 43s.6		40°
Totality ends	"	22	1	53			
Eclipse ends	"	22	3	10	$56^{\circ} E.$	$10^{\circ} E.$	29°

The Joint Committee of the Royal and Royal Astronomical Societies have determined to send out three parties to observe, one on the coast and two inland, at stations to be subsequently decided upon. It has been arranged that the party from the Solar Physics Observatory will occupy the coast station if the Admiralty can

grant the use of a man-of-war to allow an attempt to be made to repeat the *Volage* programme of 1896.

In this case the station will possibly be the old fort at Viziadurg, for which point the following astronomical conditions hold, according to the Superintendent of the Nautical Almanac (Fig. 2).

Assuming the position of Viziadurg to be $16^{\circ} 32' N.$, and $73^{\circ} 22' E.$, the times of contact are (local mean time) :—

	d.	h.	m.	s.
1898 — January	21	23	12	20
„	22	0	46	9 $P_2 = 241^{\circ}$
„	22	0	48	14 $P_3 = 51^{\circ}$
„	22	2	14	33

These times are 4h. 53m. 28s. in advance of Greenwich.

The land parties—which will include the Astronomer Royal, Prof. Turner and Mr. Newall, representing the Observatories of Greenwich, Oxford and Cambridge, together with Dr. Common and Captain Hills—will occupy stations near the central line on the railways shown on the map (Fig. 1).

With regard to the work to be attempted by the coast party, to which I propose to confine myself in what follows, I may state, in the first place, that I am one of

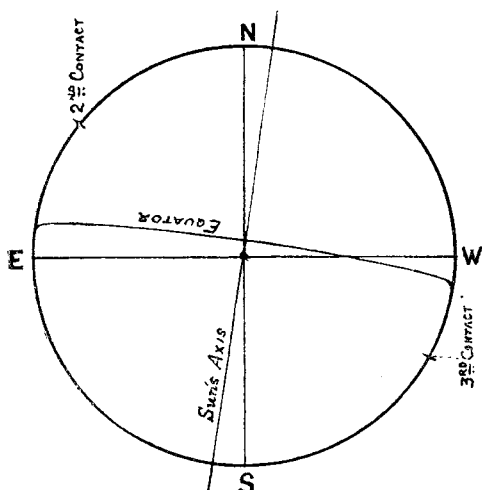


FIG. 2.—The conditions of observation at Viziadurg.

those who believe that spectroscopic observations during eclipses must take precedence of all others in the minds of students of solar physics; but when I say this, it must not be forgotten that other inquiries remain which are much more simply carried out, and are within the competence of those unacquainted with the details of the subject; one of the fortunate things about eclipses is that photographers and amateurs can do good work as well as those more fully equipped.

But to return to the spectroscope—What form of spectroscope are we to employ?

The Prismatic Camera.

Fraunhofer, at the beginning of the century, found that in order to observe the spectra of stars the best thing to do was to put a prism outside a telescope, and to let the light enter the telescope and be brought to a focus after it had passed through the prism; and it is a most unfortunate thing, that the neglect of the application of this principle has landed us probably in a delay of fifteen or twenty years in gathering knowledge on this subject. Now the spectroscopes with which most are familiar are armed with a slit through which the light to be examined is made to enter, and the rays are next rendered parallel before they enter the prism in a part of the instrument

called the collimator. After passing the prism they are again collected to a focus by means of a telescope.

But a spectroscope need not be so complicated as this, for after all the object of the instrument is to disperse white light as we see it dispersed in a rainbow, and what nature accomplishes by a rain-drop we can do by a prism; hence, if we simply pass a ray of white light through a prism, we find that after it has so passed through, it is changed into a beautiful band, showing all the colours of the rainbow. This prism then is the fundamental part of the instrument, and the most complicated spectroscope which we can imagine simply utilises the part which the prism plays in breaking up a beam of white light into its constituent parts from the red to the violet. Between these colours we get that string of orange yellow, green, and blue, which we are familiar with in the rainbow. For sixpence any of us may make for ourselves an instrument which will serve the purpose of demonstrating many important spectroscopic results. From an optician we can get a small glass prism for sixpence; glue it at one end of a piece of wood about $12 \times 1 \times \frac{1}{2}$ inch, so that we can see through it a coloured image of a needle stuck in at the other end of the piece

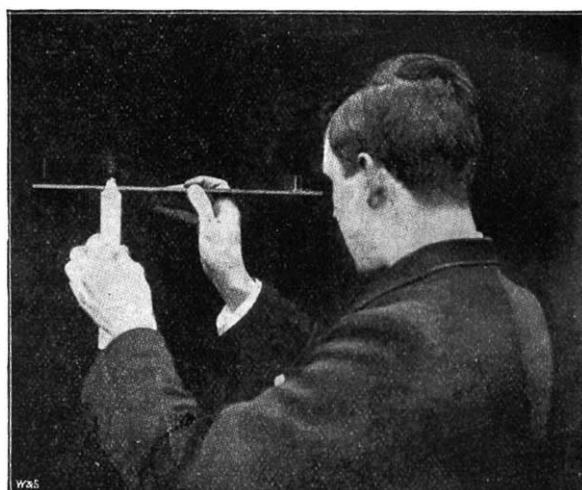


FIG. 3.—A simple form of spectroscope.

of wood (Fig. 3). This we must do by looking sideways through it.

Allow the needle to be illuminated by the flame of a spirit lamp into which salt is gradually allowed to fall. We see an image of the needle coloured in orange. If we next illuminate the needle by a candle or gas flame, taking care that the direct light from the candle does not fall upon the face of the prism, we then get no longer a single image of the needle, but a complete band of colour from red to blue. We have, in fact, an innumerable multitude of images of the needle close together.

It will be clear from these experiments that in our *impromptu* spectroscope we see simply images of the needle, few or many, according as the kind of light we are studying contains few or many differently coloured rays.

In the more complicated instrument we pass from an illuminated needle to a fine straight slit through which light is allowed to enter. We generally talk of "line" spectra for the reason that a narrow slit is employed, the image of which is a line. In the "lines" seen in the spectra of the heavenly bodies we have so many celestial hieroglyphics which we have to translate into chemical

language by comparing their positions with those we observe in the spectra of terrestrial light sources.

But a straight slit is not the only kind of aperture we can employ; we may replace it by a ring, for instance.

What we shall see in passing from the spectrum of a candle to the spectrum of a spirit-lamp flame with salt in it,

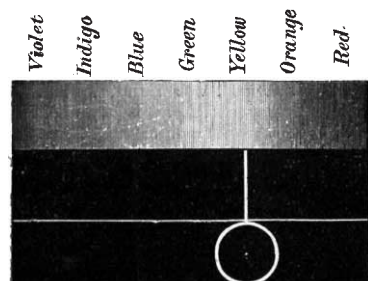


FIG. 4.—The spectra of continuous and discontinuous light sources, the latter seen with a line and circular slit.

using first a straight and then a circular slit, is shown in the accompanying woodcut (Fig. 4).

If we examine a very complicated light source we shall arrive at the same result, a spectrum characterised by a large number of bright circles or lines (Fig. 5).

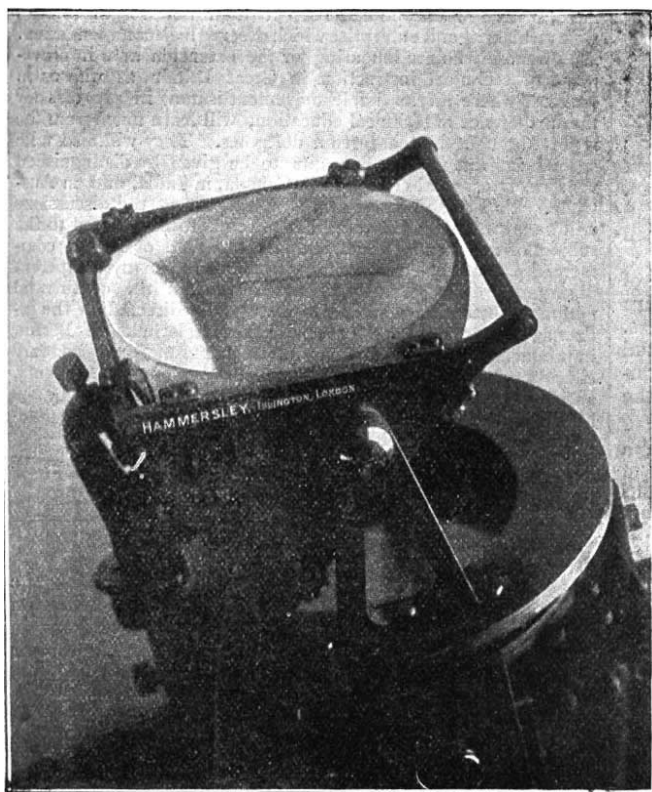


FIG. 6.—Details of objective prism.

We have seen that in an ordinary spectroscope, when we are studying light sources close to us, the rays have to be made parallel before they pass through the prism. But the heavenly bodies are at such a distance from us that their light reaches us in a parallel beam, so that one part of the spectroscope, the collimator, may be dis-

pensed with. A star as a point is part of a line slit; hence the success of Fraunhofer's arrangement for observing stellar spectra, to which I have referred. In an eclipse we get a bright narrow ring round the dark moon. There is our ring slit. Hence the so-called "slitless spectroscope," or "prismatic camera," as it is

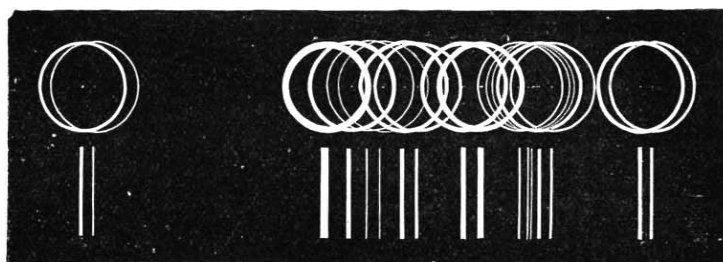


FIG. 5.—The spectrum of a complicated light-source as seen with a circular and a line slit.

called when photography is employed, used to study the spectra of stars and the sun's chromosphere during eclipses.

The way in which, in the prismatic camera, the prism is fixed outside the object-glass, is shown in the accompanying figure (Fig. 6).

We are now in a position to inquire how this arrangement has been used during eclipses since 1871.

J. NORMAN LOCKYER.

(To be continued.)

THE OLD RED SANDSTONE OF LORNE.

THE terraced hills of Lorne, though a familiar feature in the scenery of western Argyllshire, have not yet had their geology properly worked out. Their peculiar topography, however, has long been known to arise from the outcrops of successive sheets of lava, lying upon and intercalated with strata of purple shale and conglomerate. The age of these strata has never been satisfactorily settled. For many years past I have regarded them as probably belonging to the Lower Old Red Sandstone, for their lithological characters present a close resemblance to those of the great basin of that age in central Scotland, which I have distinguished by the name of "Lake Caledonia." While recently mapping in the district, Mr. R. G. Symes, of the Geological Survey, came upon an exposure of the sedimentary rocks, which seemed to him so promising a locality for fossils that he requested the assistance of one of the fossil-collectors of the staff with a view to more minute examination. Accordingly, Mr. A. Macconochie was detailed for the purpose, and was soon rewarded by the discovery of undoubted remains of plants and fishes. The specimens were first sent to the Office of the Survey in Edinburgh, where the plants were recognised by Mr. B. N. Peach as portions of *Psilophyton*, and the fish-remains as parts of *Cephalaspis*. His identification of the ichthyolites was immediately confirmed by Dr. R. H. Traquair. The specimens were then forwarded to the Jernyn Street Museum, where they have been again examined by Mr. E. T. Newton, who entirely agrees with the opinion already pronounced regarding them.

The occurrence of a genus of plants and another of fishes so characteristic of the Lower Old Red Sandstone